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| HEALTHCARE INDUSTRY |

Plumbing Design for Health Care

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Most people go to the hospital hoping to get better, but for 1 in 20 hospital patients, the opposite happens – they get worse. Part of the reason for this is that patients often have weakened immune systems because of underlying disease, transplants, chemotherapy or other factors. Another part of the reason is that hospitals contain a higher concentration of disease-causing germs and viruses than other environments. The health care profession has made great strides in reducing this problem during the past decade but there is still room for improvement. As plumbing professionals, we need to work towards better outcomes for our health care clients, their patients and their employees.

The financial and personal costs of Hospital Acquired Infections (HAIs) are a significant part of the high cost of health care in the U.S. In 2002, there were more than 1.7 million HAIs with estimated total costs between $28.4 and $33.8 billion that resulted in about 98,987 deaths. These numbers were reported in 2007, and in the last decade healthcare providers have increased their efforts to improve outcomes. The Affordable Care Act (ACA) of 2011 provides funding for public health initiatives to further improve outcomes and reduce the incidence of HAI's by doing the following:

- Improve infrastructure for preventing HAI's, mainly through reporting and data analysis
- Develop new initiatives for preventing HAI's
- Improve the National Healthcare Safety Network (NHSN) and electronic reporting of lab records to reduce data entry and improve record-keeping
- Partner with state governments to increase the number of staff dedicated to HAI prevention.

The U.S. Center for Disease Control (CDC) seeks to provide

	NAME	COMMON SOURCE	TRANSMITTED BY	LEADS TO	TYPICAL IN	REDUCE THE RISK BY:
1	Acinetobacter	soil and water	contact	pneumonia	ICU	hand hygiene
				other infections		environmental cleaning
2	B. cepacia	soil and water	contaminated medicines and devices	respiratory infections	immune suppressed	hand hygiene
			person to person contact			
3	Clostridium difficile	infected surfaces	contact	colitis	immune suppressed	disinfecting surfaces
4	Clostridium sordellii	rare	not known	pneumonia, etc.	Ob/Gyn.	being researched
5	Enterobacteriaceae (drug resistant)	human gut	contact	infection	long term care	hand hygiene
6	Hepatitis	infected people	contact	liver disease	specific populations	disinfecting devices
						laundering
7	Human Immunodeficiency Virus (HIV)	infected people	rare in hospital setting	AIDS/ infections	specific populations	personal protective equipment
8	Influenza	community (seasonal)	airborne or contact	flu	general poplulation	flue vaccine
9	Klebsiella	human gut	contact	pneumonia, etc.	general poplulation	hand hygiene
10	MRSA (drug resistant)	human nose	contact	skin infections	surgery patients	hand hygiene
11	M. abscessus	soil and water	open wounds	skin infections	wound patients	wound hygiene
12	norovirus	human gut	contact	nausea, diarrhea	immune suppressed	hand hygiene
						surface disinfection
13	Staphylococcus aureus	skin	contact	widespread infections	immune suppressed	surface disinfection
						hand hygiene
14	tuberculosis	infected people	airborne	TB	specific populations	isolation
15	Vancomycin-resistant Enterococci (VRE)	human gut		urinary tract or bloodstream infections	long term antibiotic users	hand hygiene
						surface disinfection

TABLE 1 – COMMON DISEASES AND ORGANISMS IN HOSPITAL ENVIRONMENTS

evidence-based guidance for infection control and prevention. On the CDC website, the 15 most common diseases and organisms involved in HAIs are listed. The website also provides guidance for patients and health care professionals on how to prevent these diseases. A brief summary is given in Table 1.

One other organism that has received much attention in the health care industry is Legionella, which causes Legionnaires disease. While this disease is not as common as the others listed, precautions must be taken to make sure that it does not threaten patients with weakened immune systems.

Plumbing systems in health care environments can help reduce the risk of these diseases by improving the facilities for hand hygiene, surface disinfection and medical device disinfection as well as by controlling the factors that contribute to waterborne microbial contamination.

Hand washing fixture design

The following items should be considered in the design of sinks and lavatories for hand washing in health care environments.

1. Sinks and lavatories should be conveniently located for caregivers, patients and visitors.

2. Faucets should allow "hands-free" operation (sensor operated, foot pedals or wrist blades).

3. Hot water from the spout should be 110 ° F within a few seconds of turning on the faucet.

4. The spout outlet should be raised at least 5 inches above the rim of the basin and offset several inches horizontally from the basin drain opening to avoid splashing. Splashing causes aerosolization of water borne organisms that exist at the top of the trap seal.

5. In areas where patients with compromised immune systems may be present, use laminar flow spout outlets in lieu of aerators in order to reduce aerosolization of waterborne organisms that may be present in the domestic water supply.

Surface disinfection

Increasingly, health care organizations are using chemical disinfectants instead of the traditional "mop and bucket" to clean floors. One reason for this is that ordinary detergent combined with water used in a traditional cleaning bucket becomes contaminated after one or two rooms and actually spreads germs rather than reduces them. Often, the disinfectants are dispensed through wall-mounted equipment attached to the faucet over the mop sink. This type of equipment calls for these accommodations in the design of the plumbing system in housekeeping closets:

1. Provide an external shutoff valve and check valve in each supply line to a mixing faucet at each service sink. This will reduce the likelihood of cross flow and improve the control of water temperatures.

2. Provide emergency eyewash and shower adjacent to each service sink in accordance with OSHA recommendations.

Medical device disinfection

Most hospitals include specialized equipment for disinfecting and sterilizing medical devices. Often, this equipment has stringent utility requirements in order to produce the level of disinfection required by the health care organization. Engineers and designers should work closely with the suppliers of this equipment in order to make sure that the utility requirements are met. The quality, temperatures and pressures of water supplied to washer-disinfectors and other sterilizing equipment should be closely coordinated with the equipment manufacturers. This may call for supplemental water treatment, filters, heaters, and/or pumps, depending on the overall design of the facility.

Fixture disinfection

In areas with immune-suppressed patients, shower heads and faucet laminar flow outlets should be easily removable so they can be cleaned and disinfected monthly. If hydrotherapy equipment, tubs tanks

or whirlpools are specified, the specifications should include provisions that each piece of equipment or fixture is able to be drained, cleaned and disinfected after each use.

Ice machines

Although not usually specified by the plumbing designer, ice machines can also be an opportunity for reducing the risks of water borne organisms. Ideally, ice machines should be the dispensing rather than the bin type. If they are the bin type, the scoop should be fastened to the icemaker with the shortest practical length of chain, not stored in the bin. The water supply should be provided with appropriate backflow prevention, and the drain line should extend to an air gap before discharging to the sewer system.

Water storage tanks

Ideally, a health care facility will not have to store water, but in some cases, storage of water is necessary. Stagnant water can breed microorganisms, so provisions should be made for filtering and treating the water after it leaves the storage tank and before it reaches the fixtures. Storage tanks should be cleaned in accordance with the requirements of the local health department. The design of the plumbing system should include provisions for an adequate supply of water whenever one storage tank is out of service for cleaning or repair.

Hot and cold water system design

The following items should be considered in the design of water distribution systems to prevent waterborne microbial contamination:

1. Maintain hot water return temperature at the highest temperature permitted by state regulations or codes, preferably greater than 124 ° F.
2. Maintain the cold water supply temperature at less than 68 ° F. In hot climates, this may call for a heat exchanger tied to the chilled water system.
3. Store hot water at a minimum set point of 140 ° F.
4. Distribute hot water to fixtures at 130 ° F, using a master thermostatic mixing valve to even out swings in the temperature of the stored hot water. Provide point-of-use tempering valves for hand wash facilities and provide temperature limit stops on shower and tub valves to prevent scalding.
5. Provide a point-of-use thermostatic mixing valve at each fixture to prevent scalding and deliver 110 ° water to the spout. Provide an external shutoff valve and check valve for each hot and cold water line to a mixing valve to prevent cross-flow and facilitate maintenance and repairs.
6. Maintain constant recirculation in hot water distribution systems serving patient care areas. Avoid "dead legs." Run hot water mains close to the fixtures they serve to minimize branch lengths.
7. Water supplied to automatic laundry washing machines should be at least 160 ° F.
8. Two water service pipes should be provided for a hospital arranged so as to minimize the potential for disruption of water supply if one of the pipes is out of service.
9. Ensure that the project specifications include balancing and commissioning of hot and cold water distribution systems so that these systems will function as intended.
10. Work with the owner to develop a strategy to supply water for hand washing and disinfection.

Every health care facility is unique. Designers of these facilities should work closely with the clinical and maintenance staff to ensure that the requirements for providing a reliable, clean environment are met. ●

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